

is hopeless. The field therefore for surgery in these growths is very narrow. Given the diagnosis and localization we must look upon trephining or chiseling as explorative until we find if the growth can be safely removed without subsequent cerebral œdema. Our technique here is defective and leaves, a great many difficulties to be cleared by future work.

Still more confined than the above is the scope of surgery in the field of epilepsy. Reflex epilepsy, where the aura proceeds from an injured peripheral nerve of the scalp, is the rarest of occurrences. Surgery must therefore confine itself to those cases of cortical epilepsy where the irritation proceeds from a cicatrix resulting from an injury to the brain cortex. We operate only in the hope of removing a palpable cicatrix of the brain convolution. Surgery today cannot interfere in cases of neuroses. Von Bergmann reiterates that surgery only holds out a hope of success in those cases where the epilepsy begins in a manner exactly similiar to that met with in experiments upon animals. The convulsion is initiated by the contractions of special groups of muscles. These contractions spread to those muscles of the opposite side of the body, and finally became general. Finally we have the typical pareses and paralyses in the muscles convulsed. Confining ourselves to the cases where special muscular groups are first affected (Jacksonian epilepsy) surgery will attempt to remove that part of the brain cortex (nervous centre) the irritation of which is manifested in the contractions of the muscles first affected.

The author would advise operation in those fixed forms of traumatic epilepsy having the exact Jacksonian type. In conclusion the tone of von Bergmann's paper deprecates that tentative spirit in brain surgery which operates with the vague idea of holding out some hope to the unfortunate sufferer by interference not built upon exact diagnosis by physiological experiment.

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#### THE ETIOLOGY OF FRACTURES OF THE SKULL.

Dr. Arthur W. Hare considers this subject in a lecture delivered to

the class of operative surgery in Edinburgh University. (*Lancet*, Feb. 4th, 1888).

The same laws govern large and small forces alike, and, therefore, Felizet's proposal to divide fractures into those produced by great violence and those caused by small is not justifiable. But the *way* in which the force is applied is very important. The results of a diffuse blow differ from those of a concentrated one. In a diffuse blow there is less tendency to fracture at the seat of application than at some distant point. It is therefore to diffuse blows we must turn for evidence as to the influence of its special structures upon the form and direction of the resulting fracture. The theory of *contre-coup* applies to spheres of uniform strength and of regular structure, but could scarcely apply to a construction like the skull. It was promulgated by Saucerotte, who maintained that the vibrations set up by a blow travel in all directions through the walls of the cranium, and are concentrated to a focus at the opposite point of the skull from that struck, at which point a stellate fracture is produced.

This theory has now been largely abandoned, chiefly owing to the researches of Aran, who, as the result of experiment, came to the conclusion that fractures of the base occur by the radiation of fissures from the point of application of the force. The fissures pass to the base and involve it in the fracture, taking according to Aran, the nearest route, but according to Felizet, in the majority of cases the fissures do not take the nearest route but pass downwards, in the intervals between the bony buttresses described by Hilton, where there is a greater tendency to fracture than in the costæ themselves. It is well known that Aran's experiments tend to prove that diffuse blows on the front part of the vault caused fracture of the anterior fossa, those on the middle part fractures of the middle fossa, and those on the back of the head, fracture of the posterior fossa. Sir Prescott Hewett found that a study of cases at St. George's Hospital confirmed Aran's statements.

But there are certain series of more recent experiments whose results seem to throw some doubt upon Aran's theory, and upon them has been based another theory which appears at least equally well to

explain the actual appearances in such cases. In 1872, Schwartz published the results of a series of experiments on the heads of cadavera, in which he found that on the application of force to the side of the skull fracture of the base constantly occurred in the middle fossa, and in a direction parallel to the petrous portion of the temporal bone, and thus parallel to the line of force producing it. Similarly if the force be applied to the frontal or occipital region, the fracture traverses the base diagonally; in other words in each case the line of fracture is parallel to the line of force. These results after remaining comparatively unnoticed for several years, were put to the test by Meserer, and in 1881 by Hermann, and in both cases substantially the same results have been arrived at. The former expresses his opinion as follows: "that fractures of the base always occur in the direction of the force applied, or at any rate parallel to it, and thus are not looked upon as the result of radiation, but of compression or bursting." In illustration of this view he makes use of the following illustration: "If a hollow sphere be subjected to pressure, the breakage either occurs immediately at the point of pressure, or by bursting at the most distended part."

An explanatory diagram of von Wahl's is given.

Hermann found experimentally that by applying gradual increments of force, one could watch the fracture develop itself, commencing as it always did, in what represented the equatorial zone of the base, *i. e.*, midway between the points of pressure, and extending as more force was applied in both directions parallel to the line of force toward the poles, at which it was applied, until he had obtained exactly the same appearances as those upon which Aran based his radiation theory, *viz.*, that from one of the points of application of the force a fissure ran toward the base and involved it. In this way Hermann attempts to prove that the appearances produced in Aran's experiments were due to the excessive amount of force used, which first shattered the base and then led to the formation of the radiating fissure leading to the point of application of violence. Von Wahl in his pamphlet accepts this view, and figures sixteen cases of fractured base from the surgical museum of the university of Dorpat, each accompanied by short notes of the case, which in the main bear out his views. He specially draws atten-

tion to one, which can hardly be explained on the radiation theory, as there are fissured fractures of the base quite isolated, having no radiating fissure in connection with them, passing toward the point of application of the force ; although in this case the history points to conditions exactly similar to those used by Aran in producing his experimental results—viz., a fall from a height upon the left frontal region.

Dr. Hare has within the last twelve months had a similar case in his own practice in which a blow on the lateral frontal region was followed by symptoms suggesting fracture of the base. In this case he diagnosed a fissured fracture, and defined its direction in terms of the law just mentioned. A month after the accident the diagnosis was confirmed by a post-mortem inspection, and an isolated basal fissure was discovered, involving the anterior and middle fossæ, but with no prolongation to the part of the vault struck. An illustrative drawing is given. The author, therefore, considers that we must adopt the views of von Wahl, that the fracture occurs in the line in which the force is applied or parallel to it. This, however, with certain reservations, for the experiments of Meserer and Hermann did not extend to an investigation of the remote effects on the base from injury to the vault ; and it is only in the case of forces applied to the lowest segment of the vault, or more properly to the edges of the base, that the theory of parallel cleavage is found to hold true. The holding of this theory in no way detracts from the value of Aran's experiments ; it accepts and appropriates his results, but slightly modifies his interpretation of certain of them. This modification would be a triviality were it not for the importance of the clinical issues involved, for if we can by applying the law of parallel cleavage, define the course of cranial lesions, much has been done toward removing that uncertainty which is the great bar to logical and successful treatment.

Dr. Hare finally sums up his views of the results of diffuse blows on the skull as follows : Diffuse blows produce their chief effect at a distance from the point of application ; those struck on the vault produce fissured fractures in the corresponding segment of the base ; those struck on the periphery of the base produce fissured fractures of the base of the skull parallel to the force applied.

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